Reverse-LiDAR for Alternative to Timing-Based GPS Less Prone to Jamming

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Introduction

Although innovative approaches such as *phase-borderline liquid crystal albedo* (ibid.) *analysis* for inertial navigation promise to provide a reasonably accurate alternative to GPS functionality, novel concepts for establishing a revamped GPS less prone to jamming are desired.

Abstract

Whereas helical light is able to pass through atmosphere without scattering and whereas a *frequency multiplexing prism* is capable of converting a single frequency of light into many, the unique prisms which make each of these effects possible may be used in conjunction in order to enhance the range of LiDAR.

Beyond this obvious fact, we may create something called “reverse LiDAR” in order to assess our position in space by detecting the frequency-variant emissions of multiple orbital platforms, each of which project over one trillion distinct frequencies of light toward the Earth from orbit which may be detected by a photosensor at or near ground-level.

Ordinary light would be scattered by atmosphere, making such an approach impossible without the use of helical light. The advent of helical light generation in the visible and IR bands makes such an approach feasible.

Each of the novel GPS satellites employing this approach would first utilize a *helicization prism* (ibid.) in order to helicize the light prior to the passage of the light through a *frequency multiplexing prism* (ibid.) which would necessarily have to be approximately 200x the thickness of traditional such prisms due to the ability of the helicized light to resist scattering generally. For an orbital platform, the thicker prism should not be problematical.

If one such satellite is within view, it would be possible for a user to extrapolate that they are somewhere along a one-dimensional line running from the orbital platform to the user, with trillions of individual such lines enabling each generated frequency of light to be specific to an area of roughly one square foot. Using this approach, if elevation is known, exact position may be fixed with a single satellite, meaning that ships at sea could obtain an accurate positional fix from a single satellite.

Furthermore, the ground-stations would not need to transmit a ping to an orbiting satellite in order for this system to function, enabling the use of the system whilst maintaining radio silence.

Conclusion

Importantly, given the narrow corridor of each individual sub-beam, the ability to see merely two satellites would be sufficient to provide a reasonably accurate three-dimensional positional fix to any ground-station with knowledge of the positions of the satellites. Visibility of greater numbers of GPS satellites would provide greater accuracy and redundancy, but under this paradigm, only two satellites would be needed for a three-dimensional fix and only one would be needed for a maritime positional fix. Although a high-power LASER would consume substantial energy, this LASER would only need to pulse once every second for about one millisecond and could run on battery power during the night.

This system has as a disadvantage that one must have direct line of sight with the satellite and that such a satellite's position would be plainly known to all parties. Although modern improvements to GPS satellites' method of relaying timing data back to the Earth (satellite-to-satellite LASERCOM for anonymization of position) can help to obfuscate the position of the satellites, only in military GPS systems can ground-based units' firmwares be updated in order to account for strategic and tactical alterations to the position of GPS platforms. Commercial systems rely upon GPS satellites remaining in a fixed, geosynchronous position.

Regardless, even the best-guarded military GPS platforms can be discovered even with these improvements using ground and space-based RADAR and LiDAR, can be tagged and can be tracked. All such platforms are susceptible to destruction by missile or by electromagnetic pulse. This novel system has as its advantage that it is not susceptible to radio jamming as are extant systems.